Ionospheric Science

The ionosphere is the ionized portion of the upper atmosphere extending from about 100 km above the Earth's surface to several 1000 km. It results from the direct interaction of the extreme ultraviolet (EUV) radiation from the sun with the upper atmosphere, which thus serves to shield the Earth and all of life. Although the ionosphere is created by the solar EUV radiation, at high latitudes, localized regions of additional, highly variable ionization are created when energetic electrons precipitate into the lower ionosphere from the magnetosphere above. Such events are associated with the northern and southern aurora. The ionized and neutral gases are tightly coupled via collisions, and hence their dynamics are coupled, responding to energy and momentum drivers from both the magnetosphere above and the troposphere below.

From a practical standpoint, the ionosphere enables long distance radio wave propagation to take place over a wide spectrum of frequencies. Perturbations in the ionospheric density, however, lead to the disruption of HF radio communications and navigation systems (e. g., degrading the accuracy of the Global Positioning System, or GPS). Such perturbations are caused by a variety of factors still not understood, including geomagnetic forcing and variable solar and tidal forcing. Geomagnetic activity also drives intense, rapidly varying electrical currents in the ionosphere at high latitudes which can damage power grids through the induction of large potential drops.